



Status Electronics

DWARF meeting

University of Würzburg, Feb 24, 2009

**V. Commichau, L. Djambazov, HP von Gunten, W. Lustermann, M. Morf,
U. Röser, J. Schneider, S. Stark, P. Vogler, G. Viertel, Q. Wetzel**

Introduction

Front End Boards

Power Supply Systems

M0 tests and Calibration

Trigger proposal



Introduction

GAP Camera module M0

- 144 GAPDs
- 3x3 sub-modules with 4x4 GAPDs each
- 36 readout channels
- 36 bias supply channels

CAMERA Electronics Components

- 1 CP144 (cooling plate)
- 9 SM16 (sensor module)
- 3 PB48 (pre-amplifier boards)
- 1 LVR7 (Low Voltage Regulator card)
- 1 BVD36 (Bias Voltage Distribution)
- Majority Coincidence Unit
- 1 Patch Panel
- internal wiring

DAQ system
(DRS) + Trigger

36 LEMO cables

2 x Cable
25 x 2 x 0.34

Cable 25 x 2 x 0.34 mm

Power booster
2 x 32 channels

LV power supply

Agilent HV supply

gAPD bias supply module
128 channels

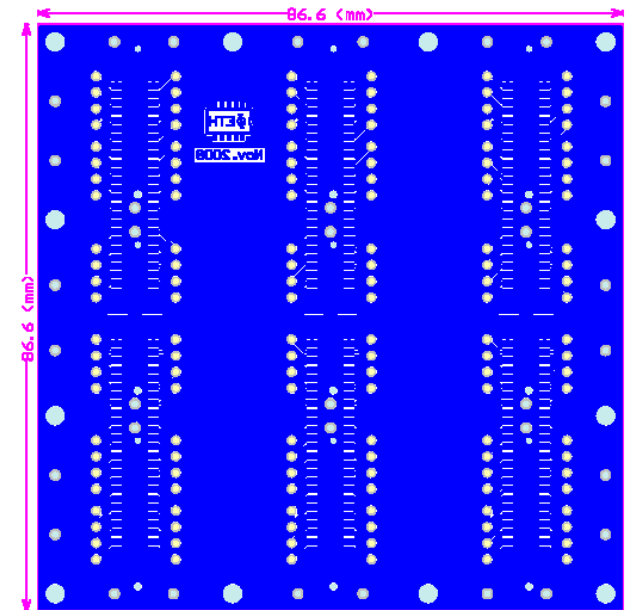


CP144

- provides the electrical interface between the sensor modules (SM16) and the pre-amplifier boards (PB48)
- houses mainly connectors on both sides
- Mechanical support of the sensor modules

Status

- Schematics → done
- Pcb layout → done
- Components → o.k.
- PCB fabrication → done
- Assembly → done
- Tests → KW 8
- **Ready end of Feb.**



In total 3 pieces fabricated (1 for M0, 1 spare, 1 for tests in ZH)

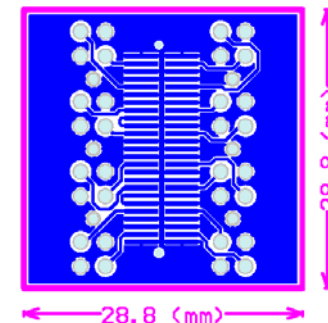
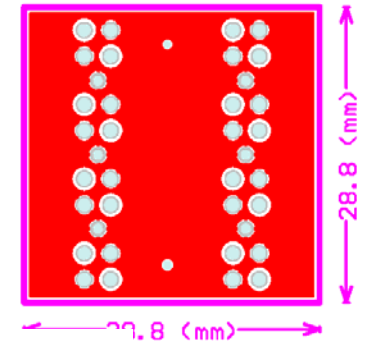


SM16

- provides the electrical interface and mechanical support for 16 GAPDs corresponding to 4 readout pixels

Status

- Schematics → done
- Pcb layout → done
- Components → o.k
- PCB fabrication → done
- Assembly → done
- Tests → KW 8
- **Ready end of Feb.**



In total 30 pieces fabricated (10 for M0)

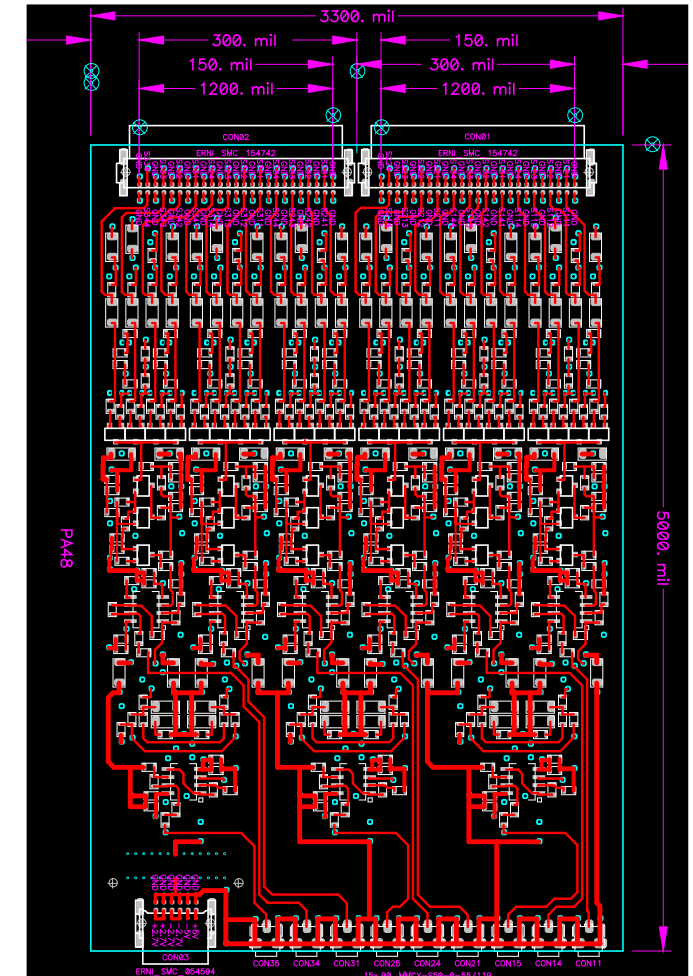


PB48

- houses 12 pre-amplifiers
- each amplifier sums the input of one pixel (4 GAPDs)
- distribution of 12 GAPD bias voltages

Status

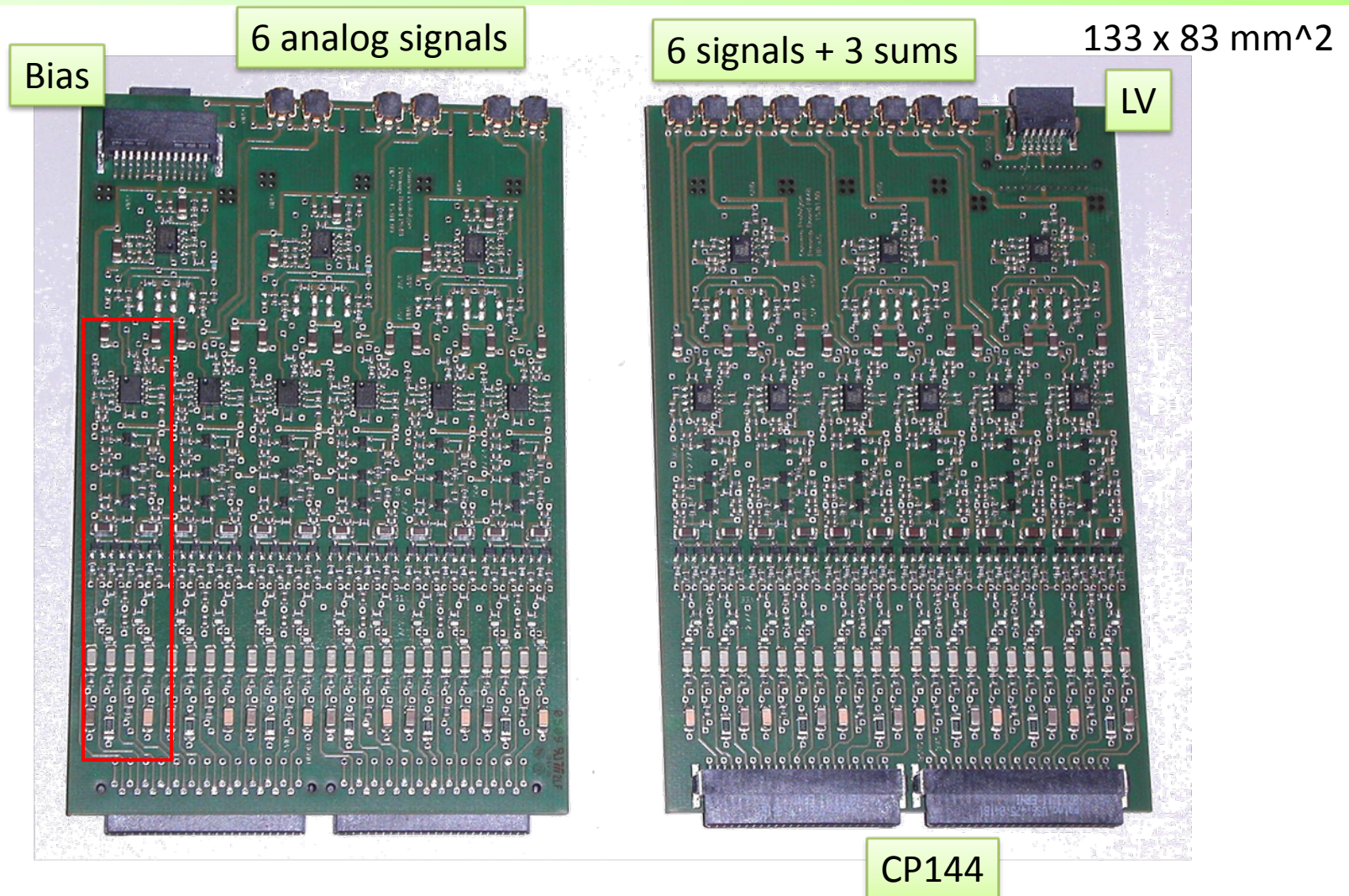
- Schematics → done
- Pcb layout → done
- Components → o.k.
- PCB fabrication → done
- Assembly → done
- Tests → KW 8/9
- Ready end of Feb., beg. of March



In total 10 pieces will be fabricated (3 for M0)

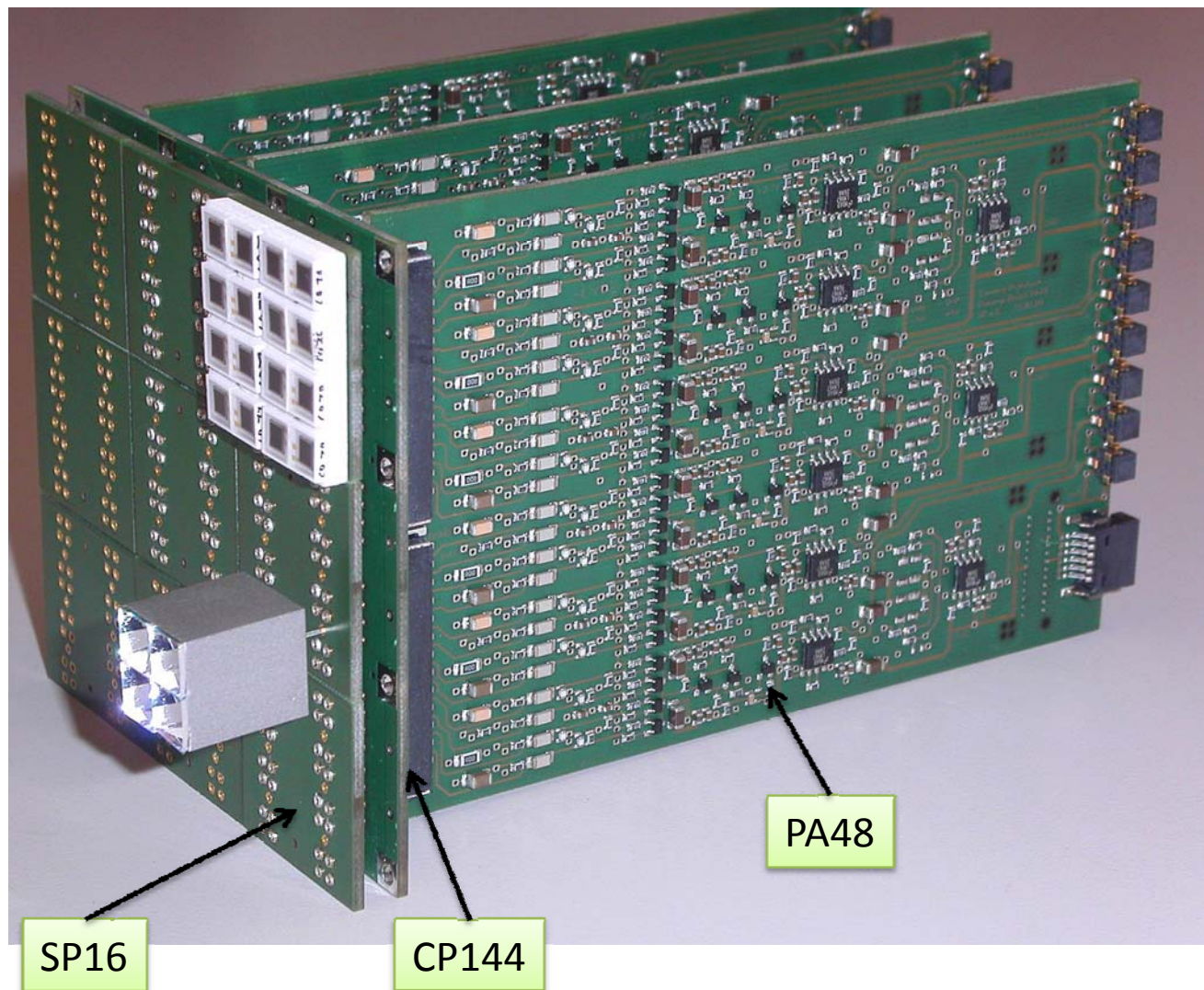


PB48





PB48





LVR7 and BVD36

- The LVR7 board houses Low Voltage Regulators for 7 different voltages
- The voltages are fanned out to 3 PB48 boards

Status

- Schematics → Done
- PCB layout → Done
- Components → delivered
- PCB fabrication → ongoing
- Assembly → one KW8
- Tests → KW 9
- **Ready beg. of March**

- The Bias Voltage Distribution (BVD), connects to two 37 pin connectors at the patch panel and distributes 12 bias voltages to each of the PB48 boards

Status

- layout of the PCB → done
- PCB production → done
- **ready beg. of March**

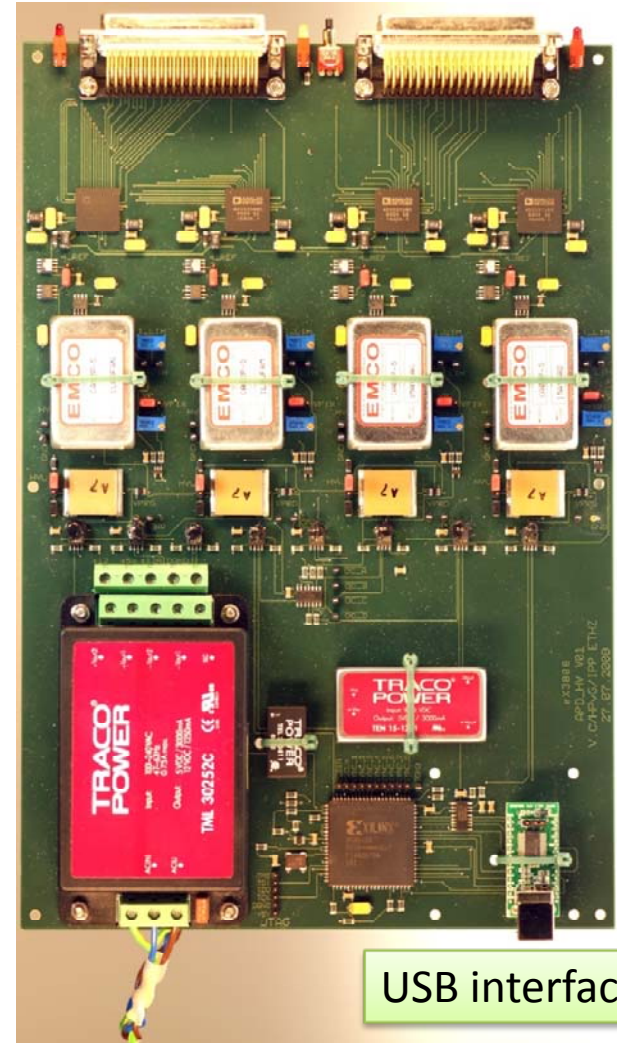


gAPD bias voltage Supply

128 channel programmable bias supply,
2 boards will be mounted into a single 19" frame

Status

- Schematics → done
- Pcb layout → ongoing
- Components → ordered
- PCB fabrication → done
- Assembly → done
- Tests → done
- Assembly and Calibration of complete modules → KW 4-7
- **2 modules tested**



USB interface



Power Booster

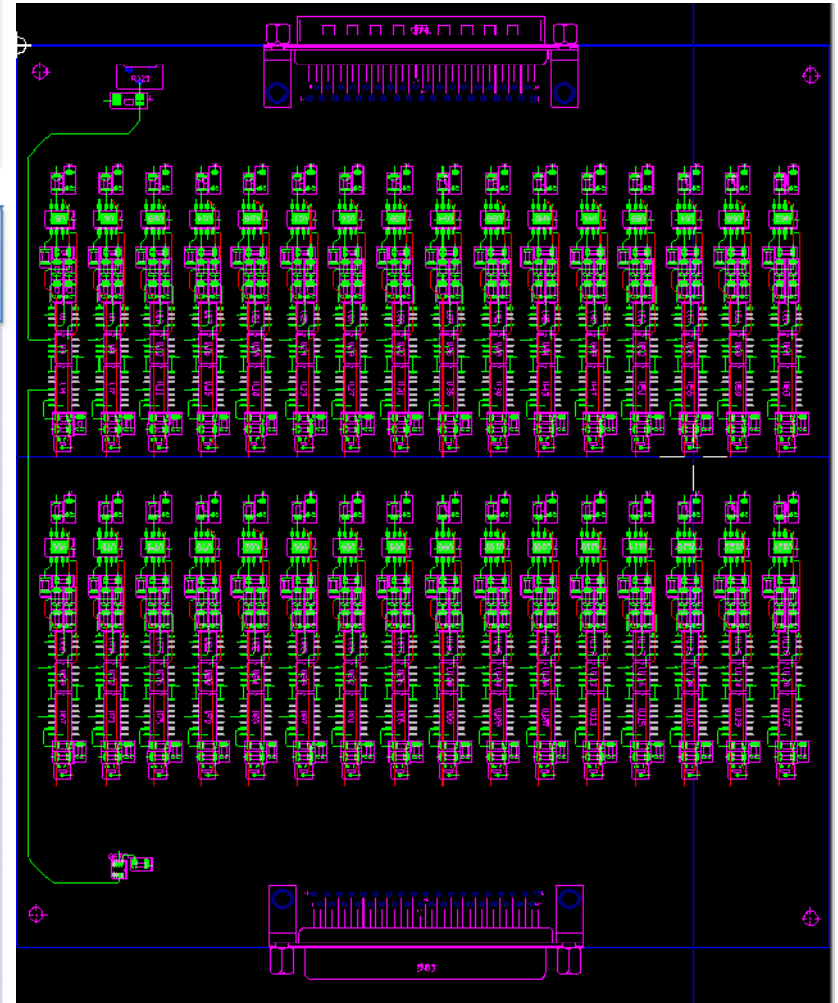
32 channel current booster

Two boards will be mounted in a 19" frame

Output current (1-4) mA

Status

- Schematics → done
- Pcb layout → done
- Components → ordered
- PCB fabrication → done
- Assembly → done
- Tests → done
- Calibration of complete modules → to be done
- **NOT mandatory for first tests with the module**





Miscellaneous

LV cables: Electronics barrack to M0 Box

- Artikel Nummer: 0789-2534, SAB BRÖCKSKES
- SD 200 C TP, 25 x 2 x 0.34 mm², outer diameter ca. : 14.7 mm, color: kieselgrau → ordered
- Must be assembled and tested → Uni Dortmund

Connectors M0

- Compatible with IP57 (water tight)
- All Connector selected and ordered (ITT Cannon, Glenair)

Majority Coincidence

- Is existing, integration into the camera system necessary
- Functionalities were successfully tested

M0 Box internal wiring

- To be defined and Components to be ordered
- To be done



Module Tests and Calibration

Cherenkov light and night sky background simulator (existing setup)

- Non-stabilized light source at room temperature:
- LED + electrical pulse (100ns, 4mA):
- The LED light pulse observed by the GAPD operated at nominal gain and amplified with the PAG20 pre-amplifier results in a signal of 0.5 V amplitude corresponding to 50% of the DRS dynamic range.
- We define this as working point and thus as starting point for the M0 calibration.

Stabilized light source

- For operation at an arbitrary temperature → test pulse with temperature stabilization or compensation is mandatory.
- permits an online adaptation of the GAPD bias voltages compensating for the drifts in environmental parameters during the measurements (NSB and GAPD temperatures).

Verify thermal behavior of PB48 in a climate chamber at 5, 15, 25 and 35°C prior to camera tests in La Palma.

Similar system for M0 is feasible. If desired, responsibilities for design, implementation and tests as well as a time line have to be defined.



Parts vs People and Time M0 box

Type of Board	Design	Material Order	Board Production	M0 Integration	# of Boards Needed	# of Boards produced	Responsible	Board Delivery	Comment
SM16	LD/HG /UR	Done	Done	TBD	9	24	(SS,PV ,UR)	31.01.09	DUT
CP144	LD/HG /UR	Done	Done	TBD	1	3	(LD/H G)	31.01.09	DUT
PB48	UR/HG	Done	Done	TBD	3	10	(HG/U R)	28.02.09	DUT
LVR7	LD/UR	Done	Done	TBD	1	6	(LD/U R)	28.02.09	TBD
BVDB	VC	Done	Done	TBD	1	5	(UR/V C/HG)	24.02.09	TBD

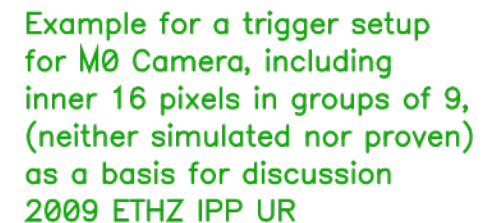
VC Volker Commichau, LD Djambazov, HG Hanspeter von Gunten,
UR Ulf Roeser, SS Sabrina Stark, PV Patrick Vogler



Parts vs People and Time M0 Elect. Barrack

Module/ Component	Design	Material Order	Module Productio n Assembly	Module Test	# of Comp. /Modules needed	# of Comp /Modules produced	Responsibl e	Date	Comments
APDHV128	VC	VC/HG	ELFAB	DUT	1	11	WL/VC/H G	31.01.09	
PB32	VC	VC	Done	TBD	(2)	4	VC		For high NSB only
FO12	MM/U R	MM	Done	MM	3	1	MM	20.12.09	1 out inv., 2 noninv.
Discriminators NIM Module						36	NN		Critical path
Major.Logic NIM Module						4	NN		Critical path
Major. Logic (Prototype)	JS/UR	JS	JS	JS	JS	JS/NN	(NN/UR)	31.02.09	For second step only
NIM Crate					1		HG		
DAQ_PC					1		OG/QW		
DAQ_VME					2		OG/QW		
Rack					1		HG		

VC Volker Commichau, HG Hanspeter von Gunten, MM Marco Morf, OG Oliver Grimm, QW Quirin Weitzel
UR Ulf Roeser, JS Joel Schneider, WL Werner Lustermann





Summary and Outlook

M0 Box

- Major Components defined
- PCB design and fabrication completed
- Completion beg. of March
- Internal wiring to be done

Electronics Barrack

- All Major Components defined
- GAPD bias supply tests and calibration ongoing
- Signal fan-out and cables to be done
- Trigger concept to be agreed
- Trigger to be prepared

Assembly and Tests

- Starting beginning of March
- Duration 4-6 weeks (optimistic)



Backup



Thermal Considerations

Power Consumption M0
test box

- Estimated: 10W (as defined mid of 2008)

Temperature stability
(important)

- $\pm 0.25^{\circ}\text{C}$ over minutes (calibration intervals)

Temperature homogeneity
(very important)

- $\pm 0.25^{\circ}\text{C}$ or better over all GAPDs

Temperature range
(known)

- $5^{\circ}\text{C} < T < 15^{\circ}\text{C}$

Temperature monitoring

- necessary to 0.2°C precision or better

The numbers depend on the desired energy resolution: **here ~5%**